
INTERNATIONAL INVESTMENTS WITH EXCHANGE RATE RISK: THE CASE OF CENTRAL AND EASTERN EUROPE CURRENCIES

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Abstract:

The paper investigates the impact that exchange rate risk has on the risk-return profile of investments in emerging countries. The emerging countries under scrutiny are Czech Republic, Hungary, Poland, Romania, Russia and Turkey, all from Central and Eastern Europe. We examine the importance of currency risk from the perspective of a US dollar based investor, by looking at the contribution that changes in exchange rates of these countries' currencies against the US dollar has for the total risk of investments in these markets, on one hand, and on the correlation between these markets' returns and the US market return. Our analysis spans over an interval between December 2005 and August, 2009, thereby taking into account the exchange rate risk contribution in normal versus turbulent times. We find that exchange rate volatility is not an additional factor for the volatility of CEE markets when returns are denominated in US dollars. In general, exchange rate risk is a positive contributor to the risk of an investment in CEE markets, and that in more turbulent times, as the ones after September 2008, the impact of exchange rate risk is higher than in normal times. Moreover, in financial crisis times we observe that currency risk lowers the correlation between the US market and CEE markets, and does not indirectly increase the risk of a US investment made in any CEE market through the correlation between markets. Therefore, even in turbulent times, portfolio diversification in CEE financial assets may prove beneficial for US investors.

Keywords: Exchange rate, currency risk, international investments, Central and Eastern Europe

1. Introduction

International investments are equivalent to investing in two different assets: the first one is the foreign stock or portfolio and the second one is represented by the foreign currency. Therefore, the actual risks and returns obtained from investing abroad are linked not only to the risk and return of the foreign asset or portfolio, but

also to the changes in the exchange rate between the foreign currency and the home or reference currency of the investor. As changes in the foreign asset prices influence the risk-return profile of the internationally diversified portfolio, so is the case with changes in exchange rates. In a world dominated by floating exchange rates, either pure or managed, the currency volatility impact on international investments outcome is by no means a minor issue. But evaluating this impact is not a simple exercise, as currency movements influence the volatility of an international investment not only directly, through their own volatility, but also through the link between foreign returns and exchange rate changes. The good news is that, sometimes, this link can actually decrease the total volatility of an investment made abroad, instead of magnifying it.

In a framework of increasing international portfolio investments and of business opportunities diversification at the global level, but also of higher capital market integration, investors critically evaluate the exchange rate risk, particularly when investments are made in emerging markets. These markets are acknowledged to have higher levels of instability, compared to developed markets, and the crises that affected emerging countries in the 1990s, but also the current financial turmoil, have demonstrated that the negative impact of exchange rate fluctuations is seriously felt by international investors. In this context, various studies raised the issue of a “legitimate” risk premium associated to investments in foreign markets that would compensate investors for taking on higher risks than at home.

Research on the links between stock market returns and exchange rate movements has developed since the beginning of the 1980s, with rather mixed evidence, depending on the methodology employed. One set of studies uses arbitrage pricing models to identify the exposure of national stock markets or various industries to exchange rate fluctuations. Aggarwal (1981) is among the first researchers that study stock prices and exchange rates and he finds a significant relationship between the appreciating US dollar and US stock prices, but a few years later Soenen and Hennigan (1988) find an opposite relationship between the two variables. Jorion (1990) examines US multinational corporations exposure to exchange rate risk for a 17 years period and concludes that share prices of these companies are not systematically influenced by changes in nominal exchange rates. Bartov and Bodnar (1994) and Choi and Prasad (1995) confirm Jorion's findings, while Gao (2000) and Koutmos and Martin (2003) seem to detect a more significant link between American companies share prices and changes in the nominal exchange rate of the dollar against various currencies. British companies also display significant exposure, according to El-Masry (2003), but depending to a large extent on the nature of their businesses. Kyimaz (2003) investigates Turkish companies for the period 1991-1998 and finds significant exposures to exchange rate risk, but also variable in magnitude from one industry to another. For the Romanian market, Horobet and Lupu (2005) analyse the January 2000 – October 2005 period and find weak significant exposures of stock returns to the euro-leu and US dollar-leu exchange rate. Horobet and Lupu (2006) extend their analysis to ten CEE countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia and Romania) by taking into consideration

changes in these countries' real exchange rates against the U.S. dollar and the euro. The results indicate the lack of contemporaneous and lagged exposures, which may be interpreted as a failure of stock market investors to incorporate changes in the competitive positions of firms in these countries in the stock returns. More recently, Horobet and Dumitrescu (2008) investigated the exposure of national stock markets from four countries in Central and Eastern Europe – Czech Republic, Hungary, Poland and Romania – to nominal and real exchange rate risk, using monthly data over the January 1999 – December 2007 timeframe. They find that companies from the region show contemporaneous and lagged exposure to nominal and real exchange rate risk and that these exposures are of the same type in all countries, suggesting a similarity in the economic structure of these countries in terms of foreign operations activity – exporting versus importing.

In this paper, our approach is different, as we examine the impact of changes in the exchange rates of a number of CEE countries against the US dollar on the risk-return profile of an investment (supposedly) made by a US investor in these markets equities. Our analysis is directed towards identifying the significance of exchange rate volatility on the total risk of an investment in each of these countries from the point of view of an investor originating in the United States or with the US dollar as reference currency. At the same time, we aim at discovering the contribution that currency risk makes to the correlation between the CEE countries stock market returns, on one hand, and the US market, on the other hand. The correlation between international markets is an important building block of the risk associated to an international portfolio and we are particularly interested in examining it in normal conditions as well as in times of financial turbulences, such as the recent ones.

The paper is structured as follows. Section 2 explains the sources of currency volatility contribution to the risk-return outcome of an international investment, Section 3 presents the data and the methodology employed in this study, Section 4 discusses the main results and Section 5 concludes.

2. Currency volatility contribution to the risk-return profile of international investments

The evolution of exchange rates represents nowadays a major source of concern from both a microeconomic and a macroeconomic perspective, given the cvasi-generalised adoption of floating rates since 1973. The exchange rate is one of the most synthetic prices in an economy and it can be considered as the expression of a general equilibrium among the market for real goods and services, the money market and the capital market, which has the obvious potential of influencing the general economic equilibrium in any economy. The diversity of factors that directly or indirectly impact exchange rates raises the issue of the easiness of managing such a complex and dynamic macroeconomic variable. The choice of an optimal exchange rate regime

is still an unresolved question of international macroeconomics, as the history of international finance shows. From the band fixed exchange rates in the '40s, '50s and '60s, countries have gradually moved towards more flexibility in their exchange rates, but a number of "intermediate regimes" have been employed at the international level with the aim of better accommodating a country's specificity with the exchange rate policy. Nevertheless, the currency crises that occurred in the last two decades - we refer to the Mexican peso crisis (1994), Asian crisis (1997-1998), Russian crisis (1998), Brazil crisis (1999) and Argentina crises (2000-2002) - have generated a growing support for clear-cut exchange rate regimes – such as hard pegged rates or free floating rates -, considered more appropriated in the current framework of higher financial integration fuelled by unprecedented capital mobility at the global level. The impact of exchange rate fluctuations is felt at the level of risk and return for any investment made abroad, in a different currency than the reference currency of the investor. Jorion (1985), Levy and Lim (1994), Eun and Resnick (1994) and, more recently, Bugar and Maurer (2002) have shown that investors that do not control for the uncertainty associated to exchange rate movements are in the difficult position of obtaining gains from international investments that do not exceed the costs attached to holding assets abroad. The explanation resides in the correlations between exchange rates, which are not sufficiently small to provide investors with enough input for achieving good diversification in an international portfolio.

The rate of return that an investor obtains from holding a foreign asset can be decomposed in three parts: the income provided by any cash flows received during the holding period ($CF_{t/t-1}$), the capital gain or loss provided by the changes in the price of the foreign asset and the currency gain or loss. Specifically,

$$r^{HC} = \left[1 + \frac{(P_t^{FC} - P_{t-1}^{FC}) + CF_{t/t-1}^{FC}}{P_{t-1}^{FC}} \right] \times (1 + s) - 1 \quad (1)$$

where P_t^{FC} and P_{t-1}^{FC} denote the prices in the local currency of the foreign asset at moments t and $t-1$, respectively, $CF_{t/t-1}^{FC}$ is the cash flow provided by the foreign investment, also in the local currency (it can be either a dividend or an interest), and s is the change in the exchange rate of the foreign currency against the home currency of the investor (the US dollar is quoted in a direct basis). Equation (1) may be re-written in the following manner:

$$r^{HC} = r^{FC} + s + (r^{FC} \times s) \quad (2)$$

where r^{HC} is the return in the home currency of the investor, r^{FC} is the return of the investment in the foreign asset in local currency terms, and s is the change in the exchange rate between the two currencies. Since typically the product $(r^{FC} \times s)$ takes small values, it is ignored for most computations of the return and risk. One may easily observe that exchange rate changes have the potential of either increasing or decreasing the return that is finally available to an investor: when the foreign currency appreciates against the home currency of the investor, this magnifies the return in the

foreign currency; the reverse is true in case of a depreciation of the foreign currency against the currency relevant to the investor.

The risk of an asset is also different when measured in different currencies. If we ignore the cross-product ($r^{FC} \times s$), we can prove that the variance of a return measured in the home currency of the investor equals the variance of the sum of the local currency return and of the exchange rate movement:

$$\text{var}(r^{HC}) = \text{var}(r^{FC} + s) = \text{var}(r^{FC}) + \text{var}(s) + 2\text{cov}(r^{FC}, s) \quad (3)$$

or

$$\text{var}(r^{HC}) = \text{var}(r^{FC}) + \text{var}(s) + 2\text{corr}(r^{FC}, s)\sigma(r^{FC})\sigma(s) \quad (4)$$

where $\text{var}(r^{HC})$ is the variance of the return measured in the home currency of the investor, $\text{var}(r^{FC})$ is the variance of the return measured in the foreign currency, $\text{var}(s)$ is the variance of exchange rate changes, $\text{cov}(r^{FC}, s)$ is the covariance between the return in the foreign currency and exchange rate changes, $\text{corr}(r^{FC}, s)$ is the correlation between the return in the foreign currency and exchange rate changes, $\sigma(r^{FC})$ is the standard deviation of return measured in the foreign currency and $\sigma(s)$ is the standard deviation of exchange rate changes. As the correlation is never greater than 1, the foreign asset risk and the currency risk are no additive, and we can prove that

$$\sigma(r^{HC}) \leq \sigma(r^{FC}) + \sigma(s) \quad (5)$$

The difference between $\sigma(r^{HC})$ and $\sigma(r^{FC})$ is called the contribution of currency risk to the risk of an international investment and it largely depends not only on the exchange rate volatility, but also on the link between the exchange rate and the foreign asset returns. There are a few noteworthy points regarding the overall impact of currency risk on an international investment. First, currency fluctuations affect both the total return and the volatility of any foreign-currency denominated investment and, from time to time, the effects of currency fluctuations on the investment return may exceed the capital gain or income, especially over short periods of time. At the same time, empirical studies indicate that currency risk, as measured by the standard deviation of the exchange rate movement, is smaller than the risk of the corresponding stock market. Second, the exchange risk of an investment may be hedged for major currencies by selling futures or forward currency contracts, buying put currency options, or even borrowing foreign currency to finance the investment, therefore currency risk can be easily eliminated in international investment strategies and does not represent a definite obstacle for international investments. Third, the contribution of currency risk should be measured for the total portfolio rather than for individual markets or securities, because part of that risk gets diversified away by the mix of currencies represented in the portfolio, as Biger (1979) and Giovannini and Jorion (1989) show. Fourth, the contribution of currency risk decreases with the length of the investment horizon, so an investor with a long time horizon should care less about

currency risk than an investor who is concerned about monthly fluctuations in the portfolio's value.

3. Data and research methodology

We use daily data on stock indices and exchange rates between December 1st, 2005 and August 31st, 2009. We employ the stock market indices from six CEE countries, namely Czech Republic, Hungary, Poland, Romania, Russia and Turkey, and a stock market index for United States. All indices are collected from the Morgan Stanley Capital International (MSCI) Database in local currencies and US dollars (USD). The exchange rates against the US dollar are collected from the Pacific Exchange Rate Service. The following time series are calculated from the data: logarithmic rates of return in local currencies, logarithmic rates of return in US dollars, logarithmic exchange rates changes, and measures of market correlations.

In order to distinguish between the impact of currency fluctuations on the risk-return profile and on market correlations in normal as compared to turbulent times, we split the whole period in a number of 45 months, aiming at studying the time-varying attributes of stock market returns and risks, currency volatility and correlations.

To measure the extent to which the local markets volatilities and correlations with the US markets are influenced by exchange rate fluctuations, we first decompose the US dollar returns obtained in CEE markets as following:

$$\begin{aligned} r_t^{USD} &= \ln P_t^{FC} S_t^{USD/FC} - \ln P_{t-1}^{FC} S_{t-1}^{USD/FC} = \ln(P_t^{FC} - P_{t-1}^{FC}) - \ln(S_t^{USD/FC} - S_{t-1}^{USD/FC}) \\ &= r_t^{FC} + s_t^{USD/FC} \end{aligned} \quad (6)$$

where r_t^{USD} is the return in the CEE markets denominated in US dollars, P_t^{FC} is the CEE stock market index at time t, denominated in local currency units, r_t^{FC} is the local currency denominated return in the CEE stock market at time t/t-1, $S_t^{USD/FC}$ is the exchange rate of the CEE currencies against the US dollar, and $s_t^{USD/FC}$ is the exchange rate fluctuation of the CEE currencies relative to the US dollar at time t/t-1. Equation (6) shows that the return obtained by a US investor in CEE markets is composed of the return in the local currency and the exchange rate fluctuation.

Moving to the risk of an investment made in CEE stock markets, we compute the variance of returns as in equation (3), as follows:

$$\text{var}(r^{USD}) = \text{var}(r^{FC}) + \text{var}(s^{USD/FC}) + 2\text{cov}(r^{FC}, s^{USD/FC}) \quad (7)$$

The proportion of US denominated CEE returns' volatility attributable to exchange rate fluctuations, which we denote by λ (lambda), may be computed as the following:

$$\lambda = \frac{\text{var}(s^{USD/FC}) + 2\text{cov}(r^{FC}, s^{USD/FC})}{\text{var}(r^{USD})} = 1 - \frac{\text{var}(r^{FC})}{\text{var}(r^{USD})} \quad (8)$$

Equation (8) shows that the proportion of CEE markets volatility that is explained by changes in the local currencies exchange rates against the US dollar depends not only on the volatility in the foreign exchange market, but also on the covariance of the CEE stock market returns and exchange rate changes. This implies that the exchange rate volatility will not necessarily induce more volatility in the returns available to foreign investors, due to the value and sign of the covariance. The contribution of exchange rate volatility to the risk of a foreign investor in CEE markets depends on the ratio between the covariance and the variance of exchange rate changes. More specifically, if $\frac{\text{cov}(r_t^{FC}, s_t^{USD/FC})}{\text{var}(s_t^{USD/FC})} > -0.5$, exchange rate fluctuations represent an additional source

of risk for the investors. Conversely, if $\frac{\text{cov}(r_t^{FC}, s_t^{USD/FC})}{\text{var}(s_t^{USD/FC})} \leq -0.5$, exchange rate fluctuations do not contribute to the volatility of returns in the home currency of the investor. We observe the evolution of λ for the entire period and for each of the 45 months in the interval.

Besides of the interest a foreign investor might have in investing in a CEE market per se, it would be also relevant to analyze the contribution that exchange rate risk has on the correlation between the respective market and the home market, presuming a desire to diversify the risk in the home market by investing abroad. We study this contribution starting from the correlation coefficient between the return in CEE markets denominated in the home currency of the investor, r_t^{USD} , and the return

obtained by the investor in his home market, denominated in US dollars, r_t :

$$\rho(r_t^{USD}, r_t) = \frac{\text{cov}(r_t^{USD}, r_t)}{\sigma(r_t^{USD}) \times \sigma(r_t)} = \frac{\text{cov}(r_t^{FC} + s_t^{USD/FC}, r_t)}{\sigma(r_t^{USD}) \times \sigma(r_t)} = \frac{\text{cov}(r_t^{FC}, r_t) + \text{cov}(s_t^{USD/FC}, r_t)}{\sigma(r_t^{USD}) \times \sigma(r_t)} = \frac{\text{cov}(r_t^{FC}, r_t)}{\sigma(r_t^{USD}) \times \sigma(r_t)} + \frac{\text{cov}(s_t^{USD/FC}, r_t)}{\sigma(r_t^{USD}) \times \sigma(r_t)} \quad (9)$$

Equation (9) shows that the exchange rate volatility influences the correlation between the two markets' returns, and its effective contribution to the correlation, denoted by ϕ (phi), can be computed as follows:

$$\phi = \frac{\text{cov}(s_t^{USD/FC}, r_t)}{\sigma(r_t^{USD}) \times \sigma(r_t)} \div \rho(r_t^{USD}, r_t) = \frac{\rho(s_t^{USD/FC}, r_t) \times \sigma(s_t^{USD/FC}) \times \sigma(r_t)}{\rho(r_t^{USD}, r_t) \times \sigma(r_t^{USD}) \times \sigma(r_t)} = \frac{\rho(s_t^{USD/FC}, r_t) \times \sigma(s_t^{USD/FC})}{\rho(r_t^{USD}, r_t) \times \sigma(r_t^{USD})} \quad (10)$$

Equation (10) allows us to observe that for given values of $\rho(r_t^{USD}, r_t)$, the values of ϕ depend on the correlation between US market returns with the change in the exchange rate of the US dollar against the local currencies from CEE, on one hand, and the ratio between the exchange rate volatility and the volatility of the CEE market return denominated in US dollars. As in the case of λ , we observe the evolution of ϕ for the entire period and for each of the 45 months in the interval.

4. Results and discussion of findings

Figure 1 shows the performance of an investment of one US dollar made in December 1st, 2005 until August 31st, 2009, in terms of monthly returns, in all the six CEE markets and, for comparison, in the United States.

For a US dollar based investor, an investment in the US market would have brought the highest cumulative return until the end of 2008, when the collapse in US stock markets made the investment of 1 USD to have only a value of 0.71 USD approximately. At the end of 2008, all the six CEE markets were able to provide a US investor with a higher cumulative return than the one obtained in the US market. The highest cumulative value at end of 2008 would have been obtained in the Hungarian market (1.2737 US dollars) and the lowest (0.7842 US dollars) in the Czech Republic. However, until August 2009 the investment in the US market recovered its lack of performance, as the cumulative value of a 1 US dollar investment, although it indicates an overall loss, was 0.7834 US dollars, higher than the cumulative value of an investment made in the Czech Republic (a cumulative value of 0.5915 USD) and in Turkey (a cumulative value of 0.7027 USD). It is interesting to note that in August 2009 the impact of the current financial crisis was largely present, as no market would have been able to provide the US investor a cumulative value of his investment higher than the initial 1 USD.

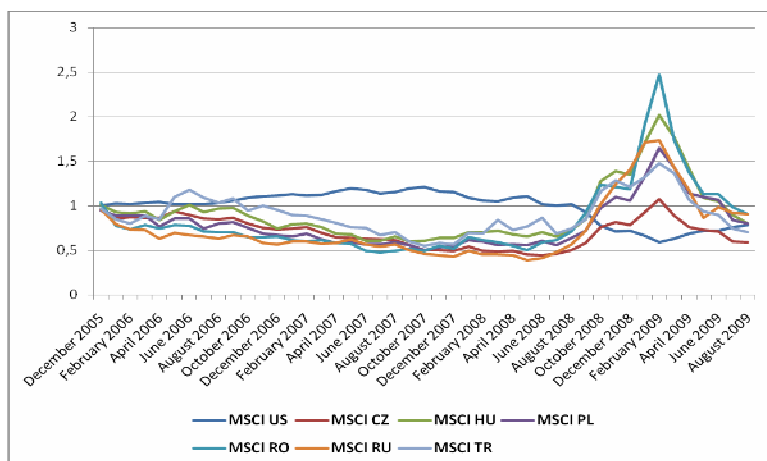


Figure 1. Cumulative value of a 1 US dollar investment in CEE markets, December 2005 – August 2009

Note: US – United States, CZ – Czech Republic, HU – Hungary, PL Poland, RO – Romania, RU – Russia, TR - Turkey

Another perspective on the performance of investments in CEE markets is provided by Table 1, which presents the values of mean daily returns, standard deviations, skewness and excess kurtosis, for stock market returns in local currencies, in US dollars and for the exchange rates against the US dollar. Overall, investments made in all CEE markets provided the US investor with small mean daily returns and comparable with the investment in the US market. Still, for four markets (Czech Republic, Hungary, Poland and Romania), the returns in USD are positive, while for the other two (Russia and Turkey) the returns are slightly negative. In terms of risk, the market that is the riskiest from the US investor's perspective is Hungary (with a standard deviation of daily returns of 0.0115), followed by Poland and Turkey. At the other end, the market with the lowest risk was Russia, followed by Romania. Another interesting point refers to the skewness of daily returns: except for Czech Republic, a US investor would obtain negatively skewed returns, actually similar to the ones in US. This is not necessarily good news from the US investor perspective, as positively skewed returns are searched for by all investors. The kurtosis values, as skewness values, indicate non-normality of returns and leptokurtic distributions in local currencies and in US dollars, thus confirming previous research on capital markets return attributes.

Table 1. Descriptive statistics of stock market returns and exchange rate changes

	MSCI US (USD)	MSCI CZ (CZK)	MSCI HU (HUF)	MSCI PL (PLZ)	MSCI RO (RON)	MSCI RU (RUB)	MSCI TR (TRL)
Mean return	-0.0002	0.0000	-0.0003	-0.0002	-0.0005	-0.0003	0.0001
Standard deviation	0.0166	0.0196	0.0226	0.0191	0.0237	0.0315	0.0219
Skewness	-0.2214	-0.5184	-0.0095	-0.1695	-2.6767	-0.4421	0.0102
Kurtosis	8.6583	12.8729	6.4644	1.9395	35.6665	13.5763	2.5050
		MSCI CZ (USD)	MSCI HU (USD)	MSCI PL (USD)	MSCI RO (USD)	MSCI RU (USD)	MSCI TR (USD)
Mean return		0.0003	0.0001	0.0002	0.0001	-0.0001	-0.0001
Standard deviation		0.0093	0.0115	0.0110	0.0085	0.0058	0.0109
Skewness		0.4192	-0.0321	-0.0271	-0.8392	-2.0798	-0.5891
Kurtosis		4.6352	4.6032	5.4579	5.5702	25.3685	6.3803
		USDCZK	USDHUF	USDPLZ	USDRO N	USD RUB	USDTRL
Mean return		-0.0004	0.0002	0.0001	0.0005	0.0004	0.0000
Standard deviation		0.0242	0.0295	0.0258	0.0271	0.0338	0.0294
Skewness		0.1147	-0.0128	0.1614	1.9098	0.4817	0.1813
Kurtosis		12.3728	7.8399	4.0499	21.9832	11.4855	3.2344

Note: CZK – Czech Koruna; HUF – Hungarian Forint; PLZ – Polish Zloty; RON – Romanian leu; RUB – Russian Ruble; TRL – Turkish Lira

When we look at the exchange rate volatility and we compare it with the volatility of the local stock markets, we observe that all exchange rates have standard deviations of their changes that are higher than the standard deviations of the local markets returns. Nevertheless, this exchange rate volatility does not seem to be an additional factor for the volatility of CEE markets when returns are denominated in US dollars: with no exception, the volatility of an investment made in CEE markets over the December 2005-August 2009 period was lower for a US investor than for a local investor, since the standard deviations of all CEE markets returns in USD are lower than the standard deviations of the markets in local currencies. This result points towards the significance of exchange rate volatility for an international investor and tells us that its influence on the risk from a US based investor is small, even negligible.

Apart from the values of standard deviations for local returns compared to the US market we were interested, as mentioned in Section 3, in investigating the effective contribution that the volatility of the local currencies exchange rate fluctuations has on the CEE market returns denominated in US dollars. As indicated by equation (8), the proportion of local market volatility explained by changes in the local currency exchange rate depends not only on the volatility in the foreign exchange market, but also on the covariance between local market returns and exchange rate changes. Ultimately, the contribution of exchange rate volatility to the risk of a foreign investor in any CEE market depends on the ratio between the covariance and the variance of exchange rate changes: when the covariance is negative and higher in value than the variance of exchange rate changes, the foreign exchange risk has a negative contribution to the overall risk, thereby reducing the risk in US dollars from an investment in a CEE market.

Figure 2 shows the values for the λ parameter for an investment in Czech Republic, Hungary and Poland, while Figure 3 shows the values for Romania, Russia and Turkey, computed for each of the 45 months in the interval. We observe for all currencies the fluctuating values of λ and, in general, its positive values, with just a few exceptions: for the CZK negative λ s were recorded for September 2006, December 2006, April 2007 and August 2007, for the HUF in April 2006, for the PLN in April 2006, December 2006 and July 2008, for the RON in December 2005, April 2007 and January 2009, and for the RUB in September 2006, December 2006, February 2007 and April 2007.

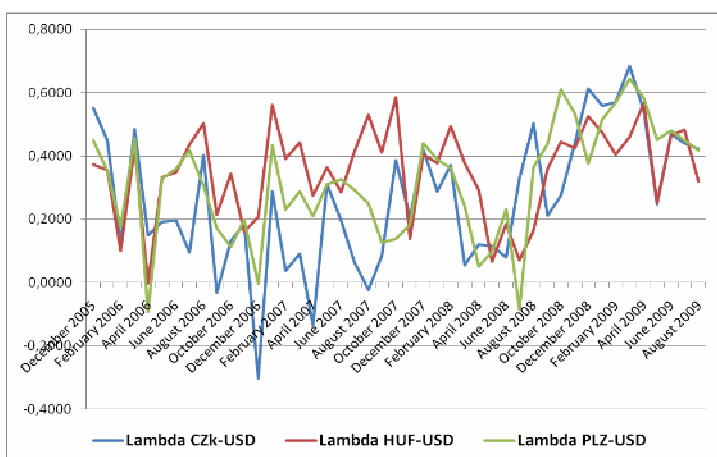


Figure 2. Lambda values for Czech Republic, Hungary and Poland, December 2005 – August 2009

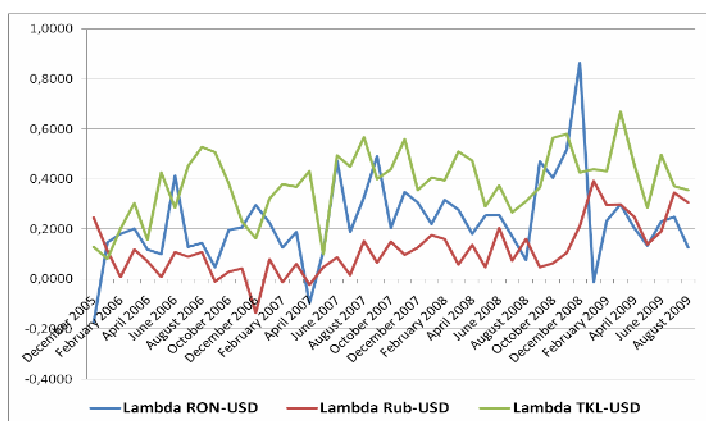


Figure 3. Lambda values for Romania, Russia and Turkey, December 2005 – August 2009

Table 2 presents the average lambda values for all currencies against the USD for the overall period, as well as for two sub-periods, chosen in such a manner as to offer a view on the influence of financial crisis on lambda: the first sub-period covers the December 2005 – September 2008 interval, and the second covers the October 2008 – August 2009 interval. We observe that average lambdas are positive for the overall period and also for the two sub-periods, but they are higher for the second sub-period than for the first one. This means that, in general, exchange rate risk is a positive contributor to the risk of an investment in CEE markets, and that in more turbulent times, as the ones after September 2008, the impact of exchange rate risk may be higher than in normal times.

Table 2. Lambda values, 2005-2009

	CZK- USD	HUF- USD	PLZ- USD	RON- USD	RUB- USD	TKL- USD
Average for Dec. 2005 – Aug. 2009	0.2637	0.3514	0.3161	0.2312	0.1174	0.3813
Average for first sub-period: Dec. 2005 – Sept. 2008	0.1944	0.3233	0.2525	0.2103	0.0792	0.3555
Average for second sub-period: Oct. 2008 – Aug.2009	0.4779	0.4383	0.5126	0.2960	0.2356	0.4611
Maximum value of lambda	0.6837	0.5862	0.6444	0.8650	0.3915	0.6681
Minimum value of lambda	-0.3034	-0.0034	-0.0914	-0.1730	-0.1354	0.0816

As an international investor is interested in diversifying asset holdings, it is relevant to analyze the contribution of exchange rate risk to the correlation between CEE markets and the home market of the investor. The parameter ϕ , defined in Equation (10) shows the contribution of exchange rate volatility to the correlation between the two markets; the average values of this parameter for the 45 months covered in our analysis, as well as for the two-subperiods (before and after the outburst of the financial crisis in October 2008) is shown in Table 3. The results are interesting and bring good news for an American investor: except for CZK for the overall period and for RUB for the first sub-periods, all ϕ values are negative, which indicates a negative contribution of exchange rate risk to the correlation between CEE markets and the US markets, thus making CEE markets a worthy adding to a US portfolio of securities. For what concerns the differences between the two sub-period, we cannot draw a clear-cut conclusion for all markets, as ϕ values are lower for some markets (Hungary and Poland) and higher for other markets (Czech Republic, Romania, Russia and Turkey). Nevertheless, in financial crisis times we observe that all ϕ values become negative, which means that currency risk lowers the correlation between the US market and CEE markets, and does not indirectly increase the risk of a US investment made in any CEE market through the correlation between markets.

Table 3. Phi values, 2005-2009

	CZK- USD	HUF- USD	PLZ- USD	RON- USD	RUB- USD	TKL- USD
Average for Dec. 2005 – Aug. 2009	0.0432	-0.9570	-0.1483	-0.2790	-0.0209	-0.1850
Average for first sub-period: Dec. 2005 – Sept. 2008	0.1600	-1.1798	-0.1555	-0.2127	0.0105	-0.1418
Average for second sub-period: Oct. 2008 – Aug.2009	-0.3176	-0.2686	-0.1260	-0.4839	-0.1180	-0.3185
Maximum value of lambda	6.7838	11.7454	7.8244	2.3649	0.7770	3.8769
Minimum value of lambda	-4.6364	-44.1456	-8.2117	-2.2646	-1.0208	-1.1234

Figures 4 and 5 show the ϕ values for all the 45 months in our time interval, presenting a different picture as in the case of lambda. For three countries – Czech Republic, Hungary and Poland – ϕ values are rather stable in time, in just a few months taking high negative values. For the other three countries we see a more fluctuating evolution of ϕ , with more positive values but also with more negative values as compared to the first three countries.

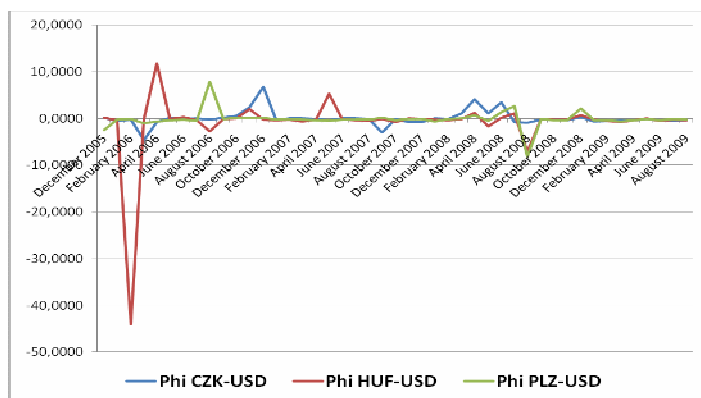


Figure 4. Phi values for Czech Republic, Hungary and Poland, December 2005 – August 2009

5. Concluding remarks

Our paper examines the impact of changes in the exchange rates of a number of CEE countries currencies against the US dollar on the risk-return profile of an investment made by a US investor in these markets equities. Our analysis is directed towards identifying the significance of exchange rate volatility on the total risk of an investment in each of these countries from the point of view of an investor originating in the United States or having the US dollar as reference currency. At the same time, we aim at discovering the contribution that currency risk makes to the correlation between the CEE countries stock market returns and the US market. The correlation between international markets is an important building block of the risk associated to an international portfolio of assets and we are particularly interested in examining it in normal conditions as well as in times of financial turbulences, such as the recent ones. We use daily data on stock indices and exchange rates over the December 1st, 2005 and August 31st, 2009. We employ the stock market indices from six CEE countries, namely Czech Republic, Hungary, Poland, Romania, Russia and Turkey, and a stock market index for United States.

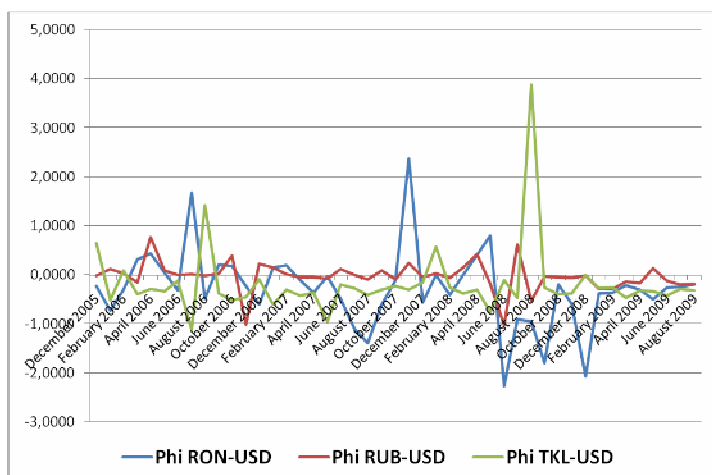


Figure 5. Phi values for Romania, Russia and Turkey, December 2005 – August 2009

We find that for a US dollar based investor, an investment in the US market would have brought the highest cumulative return until the end of 2008, when the collapse in US stock markets made the investment of 1 USD to have only a value of 0.71 USD approximately. At the same time, at the end of 2008, all six CEE markets were able to provide a US investor with a higher cumulative return than the one obtained in the US market. When we look at the exchange rate volatility and we compare it with the volatility of the local stock markets, we observe all exchange rates have standard deviations of their changes that are higher than the standard deviations of the local markets. Nevertheless, this exchange rate volatility does not seem to be an additional factor for the volatility of CEE markets when returns are denominated in US dollars.

In general, exchange rate risk is a positive contributor to the risk of an investment in CEE markets, and that in more turbulent times, as the ones after September 2008, the impact of exchange rate risk is higher than in normal times. For what concerns the indirect contribution of exchange rate risk to the risk of an investment made in CEE markets through the correlation between markets' returns, our results bring good news for an American investor: except for CZK for the overall period and for RUB for the first sub-periods, we find a negative contribution of exchange rate risk to the correlation between CEE markets and the US markets, thus making CEE markets a worthy adding to a US portfolio of securities. Moreover, in financial crisis times we observe that currency risk lowers the correlation between the US market and CEE markets, and does not indirectly increase the risk of a US investment made in any CEE market through the correlation between markets.

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References

- Aggarwal, R. (1981), “Exchange rates and stock prices: a study of the US capital markets under floating exchange rates”, *Akron Business and Economic Review*, Vol.12, No. 2, pp. 7-12
- Bartov, E., Bodnar, G. (1994), “Firm valuation, earnings expectations, and the exchange-rate exposure effect”, *Journal of Finance* Vol. 49, No. 5, pp. 1755-1788
- Biger, N. (1979), “Exchange Risk Implications of International Portfolio Diversification”, *Journal of International Business Studies*, Vol. 10, No. 2, pp. 63-74
- Bugar, G. and R. Maurer (2002), “International Equity Portfolios and Currency Hedging, The View Point of German and Hungarian Investors”, *Asian Bulletin*, Vol.32, No.1, pp. 171-197
- Choi, J., Prasad, A. (1995), “Exchange rate sensitivity and its determinants: A firm and industry analysis of U.S. Multinationals”, *Financial Management*, Vol. 24, No. 3, pp. 77-88
- De Jong, A., Ligterink, J., Macrae, V. (2002), “A Firm-Specific Analysis of Exchange-Rate Exposure of Dutch Firm” *Erasmus Research Institute of Management Working Paper*
- Doukas, J.A., Hall, P.H., Lang, L.H.P. (2003), “Exchange Rate Exposure at the Firm and Industry Level”, *Financial Markets, Institutions & Instruments*, Vol. 12, No. 5, pp. 291-346
- El-Masry, A. (2003), “The Exchange Rate Exposure of UK Nonfinancial Companies: Industry-Level Analysis” *Manchester Business School Working Paper*
- Eun, C.S., Resnick, B.G. (1994), “International diversification of investment portfolios, US and Japanese perspective”, *Management Science*, Vol. 40, No. 1, pp.140-60
- Gao, T. (2000), “Exchange rate movements and the profitability of U.S. multinationals”, *Journal of International Money and Finance*, Vol. 19, No. 1, pp. 117-134
- Giovannini, A., Jorion, P. (1989), “The Time-Variation of Risk and Return in the Foreign Exchange and Stock Markets”, *Journal of Finance*, Vol.44, No.2, pp. 307-325
- Horobet, A., Dumitrescu, S. (2008), “Insights into Central and Eastern European countries competitiveness: on the exposure of capital markets to exchange rate risk”, *Review of Economic and Business Studies*, Vol. 1, No.2, pp.107-126
- Horobet, A., Lupu, R. (2005), “Expunerea la riscul valutar a firmelor românești : o analiză sectorială”, *Oeconomica*, year XIV, no. 4, pp. 107-136
- Horobet, A., Lupu, R. (2006), “Real exchange rates and corporate performance: a comparative analysis for CEE countries”, *Proceedings of the 2006 International*

Conference on Commerce, Academy of Economic Studies Bucharest, Romania, pp. 272-281

Jorion, P. (1985), "International Portfolio Diversification with Estimation Risk", *Journal of Business*, Vol.58, No.3, pp. 259-278

Jorion, P. (1990), "The exchange rate exposure of U.S. multinationals", *Journal of Business*, Vol. 63, No. 3, pp. 331-345

Koutmos, G., Martin, A. (2003), "First- and Second-Moment Exchange Rate Exposure: Evidence from U.S. Stock Returns", *The Financial Review*, Vol. 38, No. 3, pp. 455-471

Kyimaz, H. (2003), "Estimation of foreign exchange exposure: an emerging market application", *Journal of Multinational Financial Management*, Vol.13, No. 1, pp. 71-84

Levy, H., Lim, K.C. (1994), "Forward Exchange Bias, Hedging and the Gains from International Diversification of Investment Portfolios", *Journal of International Money and Finance*, Vol.13, No. 2, pp. 159-170

Soenen, L.A., Henningan, E.S.(1988), "An analysis of exchange rates and stock prices-the US experience between 1980 and 1986", *Akron Business and Economic Review*, Vol.19, pp.7-16